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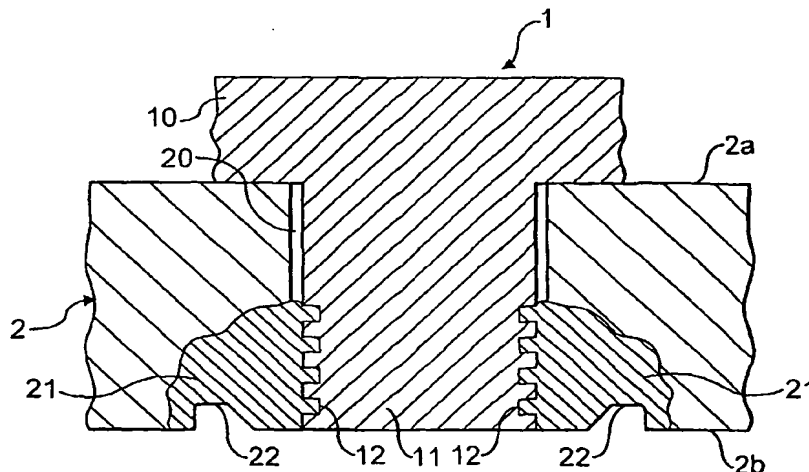
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO A RAILWAY RAIL SUPPORT



(57) Abstract: In a method of attaching a steel railway rail support (baseplate or sleeper) (2) to a ductile iron rail clip anchoring device (1) a boss (11), extending from the bottom of a body (10) of the anchoring device (1), is inserted into a hole (20) passing through the support (2) at a location on its surface (2a) at which the anchoring device (1) is to be attached until the anchoring device body (10) abuts the support surface (2a). The steel around the hole (20) in a region on the support surface (2b) opposite to that on which the anchoring device body (10) is located is compressed while the anchoring device (1) is held in place, so that the compressed steel flows plastically against the boss (11) within the hole (12), until the force applied to the boss (11) brings about elongation thereof, whereby the boss (11) undergoes an elastic set which clamps the boss (11) to the support (2).

about elongation thereof, whereby the boss undergoes an elastic set which clamps the boss to the support.

This method is quick and simple and has the additional advantages that (a) there is no requirement  
5 for a separate fastening component, (b) there is no need to induce heat into either component, (c) there is no need to clean rust or scale from either component, and (d) the method can be performed with common metalworking tools. Furthermore, unlike methods which  
10 simply hold the shoulder in place, a shoulder and support joined using this method must undergo stress reversal before they can be separated.

Preferably, the boss is provided with at least one recess in its flank and the compressed steel also flows  
15 plastically into that recess. Desirably, the recess comprises a single non-helical groove extending around the boss. Alternatively, the flank of the boss may be provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

20 The step of compressing the steel around the hole is preferably performed by applying a penetrating tool, having a working face of desired shape, to the surface of the support opposite to that on which the anchoring device body is located until the tool has entered the  
25 sleeper surface for a desired distance. The penetrating tool may be shaped to allow the said elongation of the boss.

The step of inserting the boss into the hole in the support may be performed by supporting the  
30 anchoring device so that the boss extends upwardly and then lowering the support such that the boss passes through the hole.

Typically, the support will be provided with two such holes and the method will be carried out simultaneously with respect to both holes thereby to attach two anchoring devices to the support.

5       The or each hole may be punched into the steel support.

According to a second aspect of the present invention there is provided a rail clip anchoring device, for use with a method embodying the first  
10       aspect of the present invention, which device has an anchoring device body and, extending from the bottom of that body, a boss provided with at least one recess in its flank, the recess comprising a single non-helical groove extending around the boss.

15       According to a third aspect of the present invention there is provided a railway rail fastening assembly comprising a steel railway rail support, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device  
20       having an anchoring device body and, protruding from the bottom of that body, a boss which extends into a respective one of the said holes in the support, the boss of each anchoring device having an elastic set whereby the boss is clamped to the support, wherein the  
25       boss of at least one of the anchoring devices has at least one recess provided in its flank, the recess comprising a single non-helical groove extending around the boss. The boss may be provided with a plurality of recesses, each comprising a non-helical groove  
30       extending around the boss.

The profile of the or each groove is preferably substantially that of a buttress thread. 15. The or

each recess is preferably provided adjacent a free end of the boss.

Reference will now be made, by way of example, to the accompanying drawings, in which:

5        Figures 1, 2 and 3 show in perspective respective simplified representations of a shoulder, a portion of a baseplate and a penetrating tool for use in a method embodying the first aspect of the present invention;

10       Figures 4 to 8 illustrate steps in a method embodying the first aspect of the present invention;

      Figure 9 shows a typical groove profile used in a shoulder embodying the second aspect of the present invention; and

15       Figures 10 to 12 show views of a baseplate/shoulder assembly produced using a method embodying the first aspect of the present invention.

      In a method embodying the first aspect of the present invention a ductile iron rail clip anchoring device, hereafter called a shoulder, is attached to a steel baseplate. A simplified representation of a shoulder 1 is shown in Figure 1. The shoulder 1 is a ductile iron casting and has a body 10 from which there extends a cylindrical elongate boss 11 provided around its flank with a plurality of grooves 12 spaced along its length, the first of the grooves 12 being adjacent to the free end 13 of the boss 11. The boss 11 may be of any length less than or equal to the thickness of the baseplate 2 to which the shoulder 1 is to be attached and can be of any cross-sectional shape, although for ease of manufacture a cylindrical cross-section is preferred.

      A simplified representation of a portion of a rolled steel baseplate 2 to which the shoulder 1 of

Figure 1 may be attached is shown in Figure 2, the baseplate 2 having a throughhole 20 of cylindrical cross-section. Each baseplate 2 will have two such holes 20, preferably formed by punching through the baseplate 2, at locations corresponding to the desired positions of the respective shoulders 1 to be fastened to the baseplate 2. The baseplate 2 has a top face 2a and a bottom face 2b.

In a method embodying the first aspect of the present invention, as shown in Figure 4 firstly two shoulders 1 (only one shown throughout) are held in a fixture jig 4 (not shown in Figure 4) such that their respective bosses 11 extend upwardly. The baseplate 2 is then positioned, with its top face 2a facing downwards, as shown in Figure 5, such that the holes 20 therein slip over the bosses 11 and the top face 2a of the baseplate 2 makes contact with the respective bodies 10 of the shoulders 1. Using a press (not shown), for example a mechanical or hydraulic metal working press of around 200 ton (203.21 tonnes) capacity, a penetrating tool 3 is brought into contact with the bottom face 2b of the baseplate 2, as shown in Figure 6. As shown in Figure 3 the tool 3 is similar to a hollow punch, having a circular working face 30 and a void 31. The working face 30 of the tool 3 is chosen so as to be a little larger in diameter than the hole 20 in the baseplate 2 and in use is brought into contact with the region of the bottom face 2b of the baseplate 2 around the hole 20. As shown in Figure 7 the press forces the tool 3 against the bottom face 2b of the baseplate 2 until the shear strength of the baseplate material is exceeded, whereupon the working face 30 of the tool 3 penetrates the bottom face 2b for

a predetermined distance. As a result, steel in the region of the baseplate 2 where the tool 3 has penetrated flows plastically into the grooves 12 and exerts a compressive force against the flank of the boss 11 which acts in such a way that the boss 11 deforms, i.e. stretches. Since the boss 11 is constrained at one end by the body 10 of the shoulder 1 held in the fixing rig 4, the boss 11 can stretch only upwardly, towards the opening of the hole 20 in the bottom face 2b of the baseplate 2. The void 31 is provided in the tool 3 to allow for this to happen while the tool 3 is being pressed into the baseplate 2. The stretching of the boss 11 results in an elastic set in the boss 11, which remains after the penetrating tool 3 is backed off, and produces a restoring clamping force, similar to that provided by a bolt, which holds the shoulder 1 on the baseplate 2. This stress, acting normal to the baseplate surface 2a, must be overcome (reversed) before any load applied to the shoulder 1 can succeed in lifting the shoulder 1 from the baseplate 2. The assembled shoulder 1 and baseplate 2 are shown in Figures 8, 10 and 11. Retention of the shoulder 1 on the baseplate 2 is assisted by frictional resistance between the boss 11 and the baseplate material in contact with it, and by the steel forced into the grooves 12 in the boss 11 which is in shear at the interface between the boss 11 and the baseplate 2. Although Figure 1 and related Figures show a shoulder 1 having a plurality of grooves 12, a method embodying the first aspect of the invention could usefully employ a boss 11 without any grooves 12 or other recesses, in which case the clamping force between the shoulder 1 and baseplate 2 would not be as great. Preferably,

however, a boss 11 having a single, coarser groove may be used instead, as shown in Figure 12, and in fact such an arrangement is likely to be more effective than a plurality of grooves and would be easier to manufacture. Figure 12 shows a section through a baseplate 2, to which a shoulder 1 had been attached using a method embodying the first aspect of the present invention and has now been removed following cutting of the baseplate 2. An indent 22 left by the action of the penetrating tool 3 on the bottom face 2b of the baseplate 2 can be seen. A groove 12 having a modified buttress thread profile, where the direction of axial loading is opposite in direction to a normal buttress thread, is preferred, as shown in Figure 9. Typical values for the dimensions and angles of the groove 12 shown in Figure 9 are:  $a=6.96\text{mm}$ ,  $b=4.00\text{mm}$ ,  $c=1.70\text{mm}$ ,  $d=1.20\text{mm}$ ,  $e=0.50\text{mm}$ ,  $A=87^\circ$ ,  $B=58^\circ$  and  $C=35^\circ$ .

CLAIMS

1. A method of attaching a steel railway rail support  
to a ductile iron rail clip anchoring device, which  
5 method comprises:

inserting a boss, protruding from the bottom of a  
body of the anchoring device, into a hole passing  
through the support at a location on its surface at  
which the anchoring device is to be attached until the  
10 anchoring device body abuts the support surface; and  
compressing the steel around the hole in a region  
on the support surface opposite to that on which the  
anchoring device body is located, while the anchoring  
device is held in place, so that the compressed steel  
15 flows plastically against the boss within the hole,  
until the force thereby applied to the boss brings  
about elongation thereof, whereby the boss undergoes an  
elastic set which clamps the boss to the support.

20 2. A method as claimed in claim 1, wherein the boss  
is provided with at least one recess in its flank and  
the compressed steel also flows plastically into the  
said recess.

25 3. A method as claimed in claim 2, wherein the recess  
comprises a single non-helical groove extending around  
the boss.

4. A method as claimed in claim 2, wherein the flank  
30 of the boss is provided with a plurality of recesses,  
each comprising a non-helical groove extending around  
the boss.



5. A method as claimed in any preceding claim,  
wherein the step of compressing the steel around the  
hole is performed by applying a penetrating tool,  
having a working face of a desired shape, to the  
5 surface of the support opposite to that on which the  
anchoring device body is located until the tool has  
entered the support surface for a desired distance.
6. A method as claimed in claim 5, wherein the said  
10 penetrating tool is shaped to allow the said elongation  
of the boss.
7. A method as claimed in any preceding claim,  
wherein the step of inserting the boss into the hole in  
15 the support is performed by supporting the anchoring  
device so that the boss extends upwardly and then  
lowering the support such that the boss passes through  
the hole.
- 20 8. A method as claimed in any preceding claim,  
wherein the support is provided with two such holes and  
the method is carried out simultaneously with respect  
to both holes thereby to attach two anchoring devices  
to the support.
- 25 9. A method as claimed in any preceding claim,  
wherein the said hole or holes are punched into the  
steel support.
- 30 10. A method as claimed in any one of claims 1 to 9,  
wherein the said railway rail support is a railway  
sleeper.

11. A method as claimed in any one of claims 1 to 9, wherein the said railway rail support is a railway rail baseplate.

5 12. A rail clip anchoring device, for use with the method of any preceding claim, which device has an anchoring device body and, protruding from the bottom of that body, a boss provided with at least one recess in its flank, the recess comprising a single non-  
10 helical groove extending around the boss.

13. A device as claimed in claim 12, wherein the flank of the boss is provided with a plurality of such recesses.

15

14. A device as claimed in claim 12 or 13, wherein the profile of the or each groove is substantially that of a buttress thread.

20 15. A device as claimed in any one of claims 12 to 14, wherein the or each recess is provided adjacent a free end of the boss.

16. A railway rail fastening assembly comprising a  
25 steel railway rail support, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device having an anchoring device body and, protruding from the bottom of that body, a boss which extends into a respective one of the  
30 said holes in the support, the boss of each anchoring device having an elastic set whereby the boss is clamped to the support, wherein the boss of at least one of the anchoring devices has at least one recess

provided in its flank, the recess comprising a single non-helical groove extending around the boss.

17. An assembly as claimed in claim 16, wherein the  
5 flank of the boss is provided with a plurality of such recesses.

18. An assembly as claimed in claim 16 or 17, wherein  
the profile of the or each groove is substantially that  
10 of a buttress thread.

19. An assembly as claimed in any one of claims 16 to  
18, wherein the or each recess is provided adjacent a  
free end of the boss.

15

20. An assembly as claimed in any one of claims 16 to  
19, wherein the said railway rail support is a railway  
sleeper.

20 21. An assembly as claimed in any one of claims 16 to  
19, wherein the said railway rail support is a railway  
rail baseplate.

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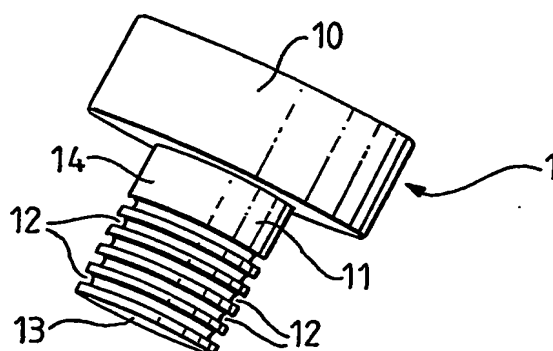


FIG. 1

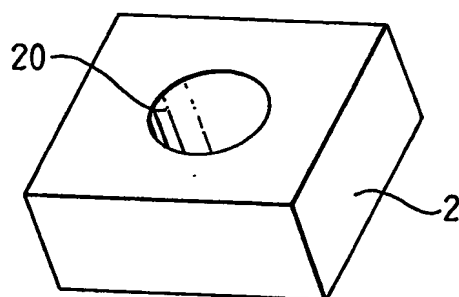


FIG. 2

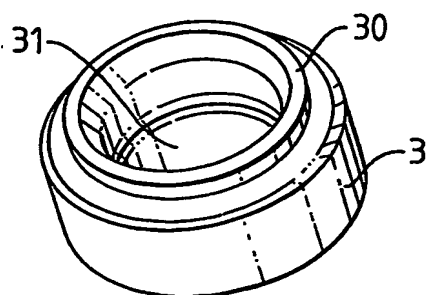


FIG. 3

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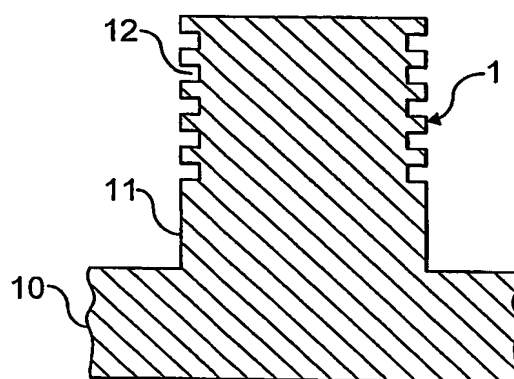
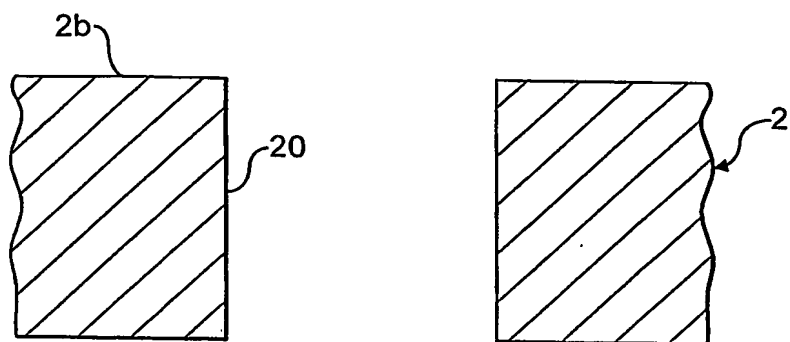


FIG. 4

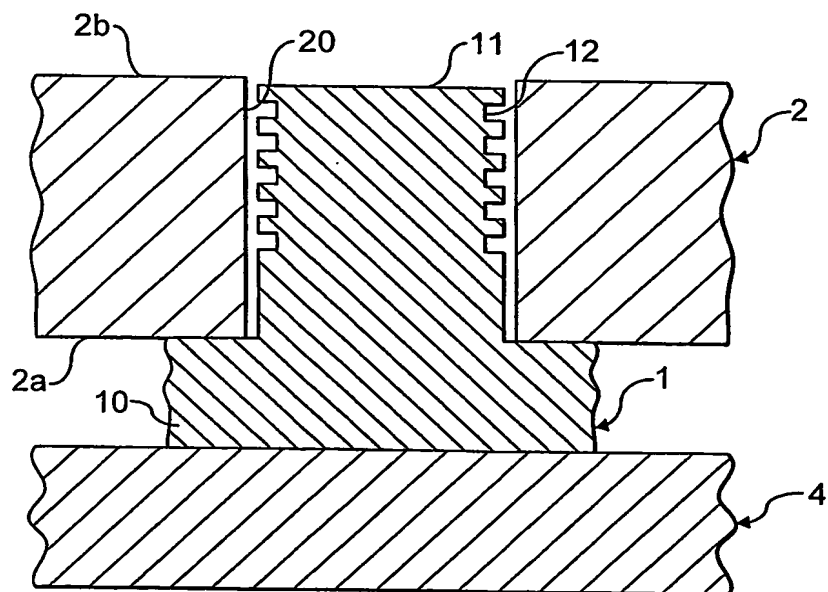


FIG. 5

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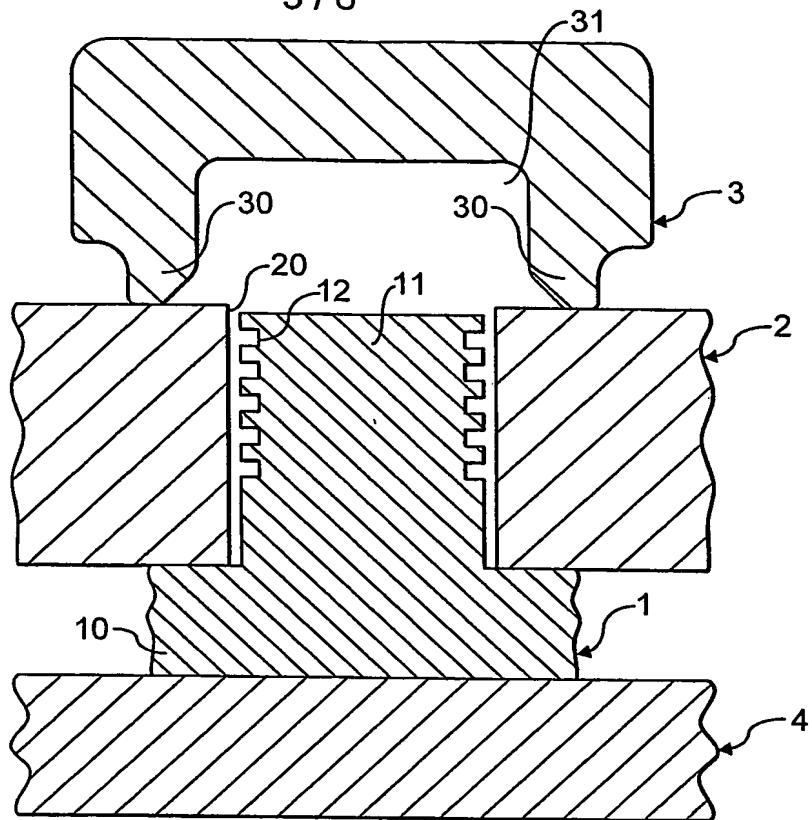


FIG. 6

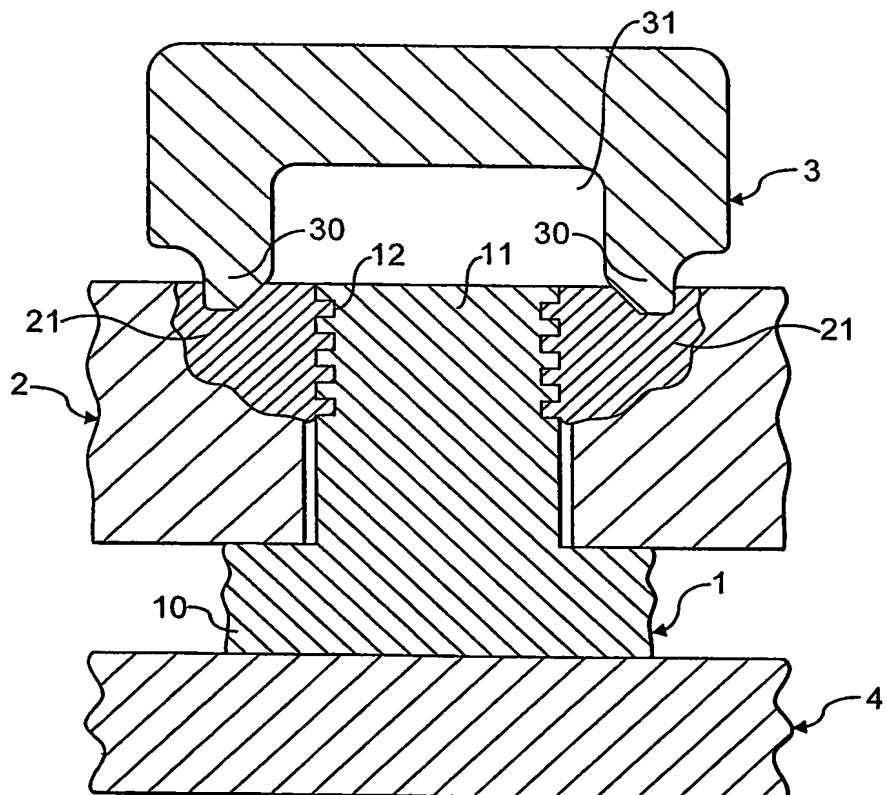


FIG. 7

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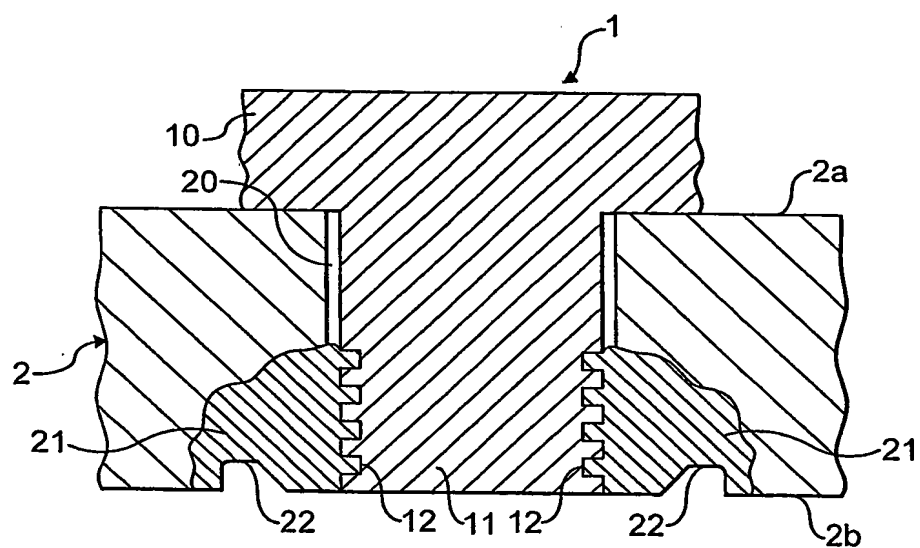


FIG. 8

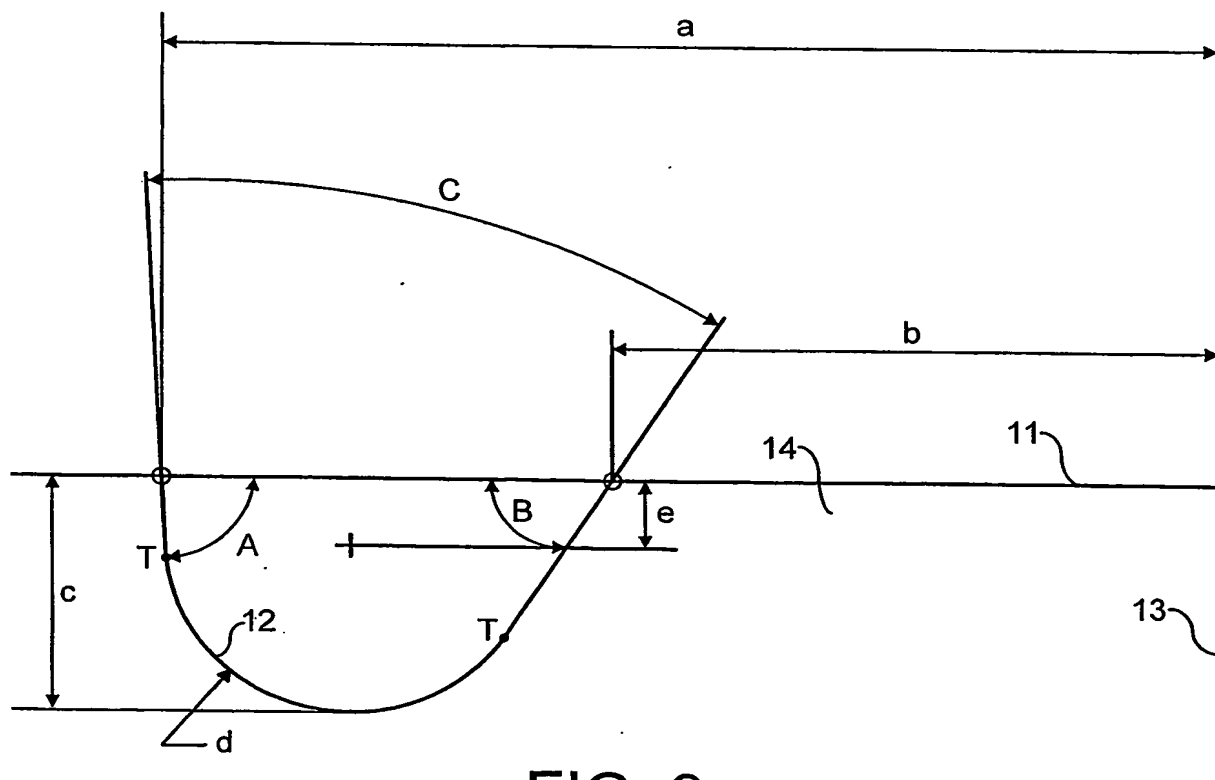


FIG. 9

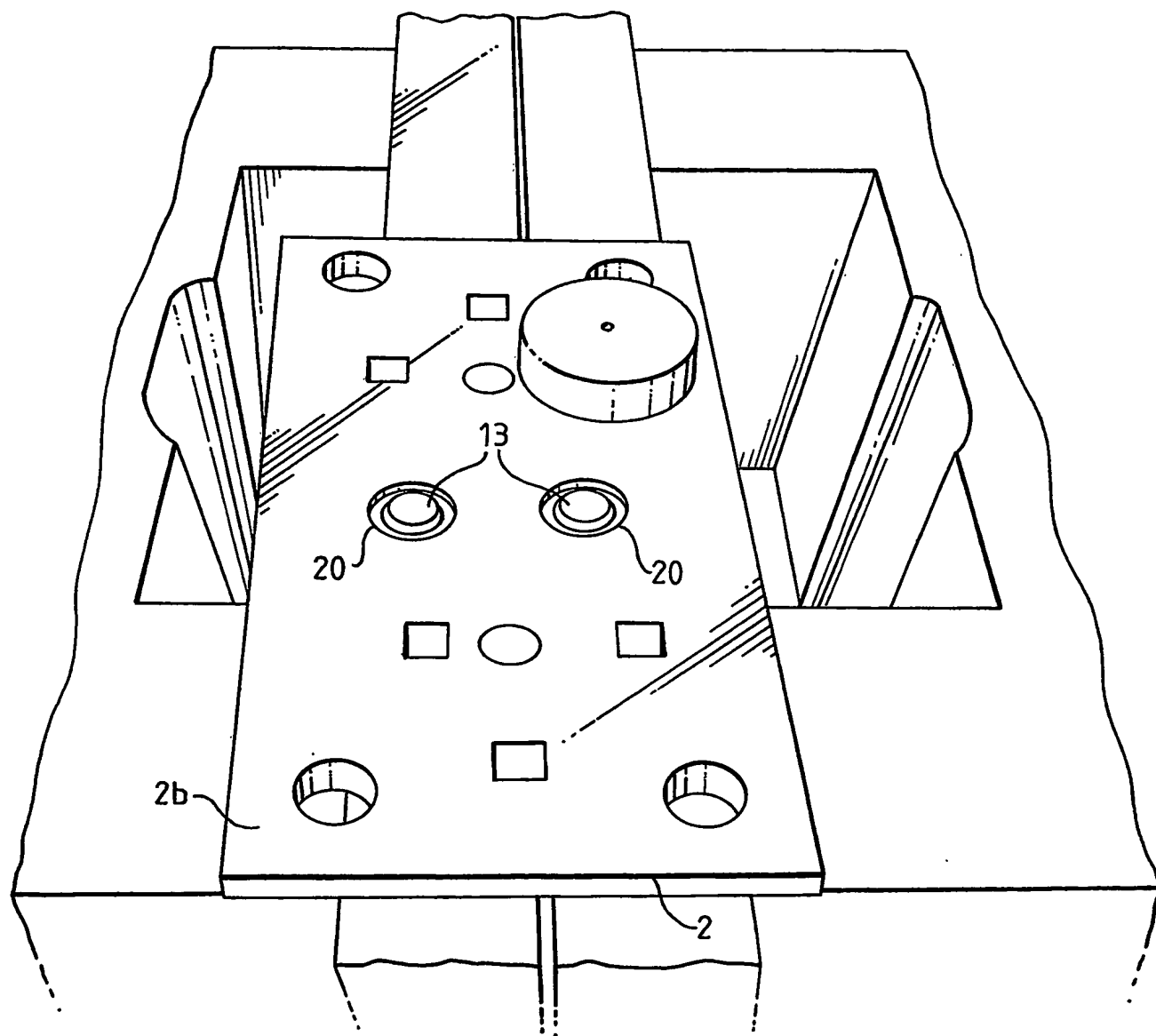


FIG. 10



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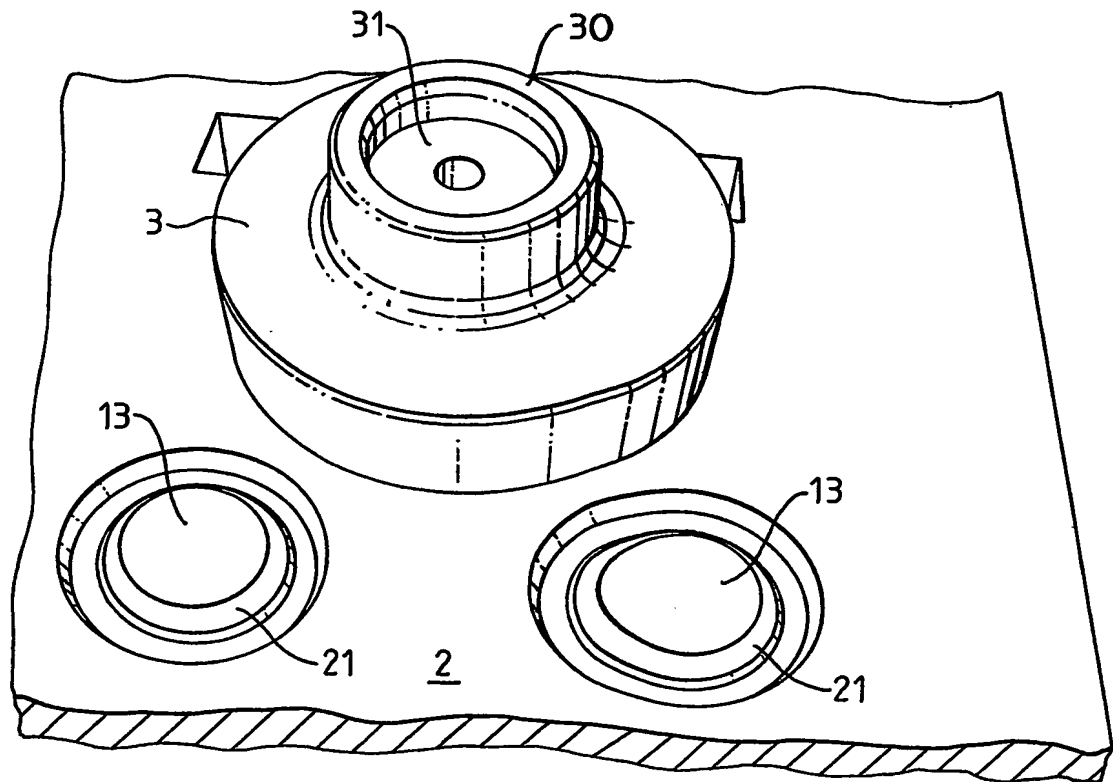


FIG. 11

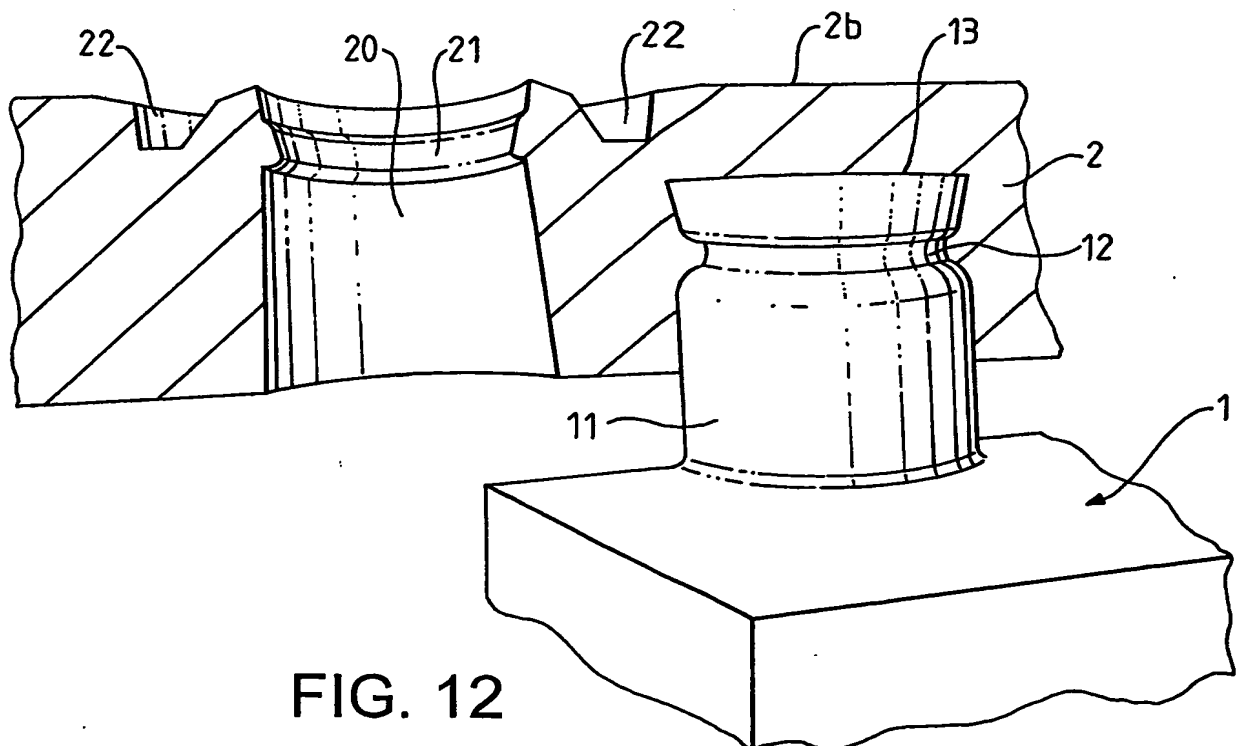


FIG. 12

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 03/04323

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 E01B9/40 F16B37/06		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 E01B F16B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the International search (name of data base and, where practical, search terms used) EPO-Internal, PAJ, WPI Data		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CH 319 878 A (RIEDENER FRANZ DR) 15 March 1957 (1957-03-15) page 1, line 1 -page 1, line 6 page 1, line 29 -page 1, line 48 page 2, line 55 -page 2, line 77 figures 1,2	1,5,10, 12,16,20
A	DE 35 19 914 A (RAILBOUW BV) 12 December 1985 (1985-12-12) page 7, paragraph 4 -page 8, paragraph 1 figures 1-6	1,8,11, 12,16,21
A	JP 55 081901 A (TETSUDOU KIZAI KOGYO KK) 20 June 1980 (1980-06-20) figures 1-5	12-14, 16-18,20
-/--		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "8" document member of the same patent family		
Date of the actual completion of the international search  8 January 2004		Date of mailing of the international search report  15/01/2004
Name and mailing address of the ISA European Patent Office, P.B. 5618 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016		Authorized officer  Hendrickx, X

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 03/04323

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	DE 101 08 189 A (DAIMLER CHRYSLER AG) 12 September 2002 (2002-09-12) claim 1; figures 1-3 ---	1-3,5,7
A	US 6 220 804 B1 (PAMER W RICHARD ET AL) 24 April 2001 (2001-04-24) claim 1; figures 5,6 -----	1,9

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